



GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Diploma Engineering

Level: Diploma

Branch: Computer Engineering / Computer Science & Engineering

Cyber System & Information Security

Subject Code : DI03000011

Subject Name : Digital Electronics Fundamentals

w. e. f. Academic Year:	2024-25
Semester:	3 rd
Category of the Course:	ESC

Prerequisite:	---
Rationale:	Digital Electronics is a foundational Course. It is designed to build essential skills in understanding and designing digital systems. The course covers the conversion of numbers between binary, decimal, octal, and hexadecimal systems, enabling students to grasp how computers represent and process data. By applying Boolean algebra and Karnaugh Maps (K-Maps), students learn to optimize logical expressions and design efficient circuits. Practical exposure to constructing combinational circuits, such as adders and multiplexers, and understanding sequential circuits like latches and flip-flops, equips students with the knowledge to design digital systems. This course lays the groundwork for advanced studies and real-world applications in the field of computer engineering

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes	RBT Level
01	Perform Conversion of Given number between various types of number	Apply
02	Apply Boolean Algebra for circuit optimization	Apply
03	Optimize Given Boolean expression with K-Map	Apply
04	Construct Various types of Combinational Circuits	Apply
05	Recognize Latch and Flip –Flops as Sequential Circuits	Apply

*Revised Bloom's Taxonomy (RBT)

Teaching and Examination Scheme:

Teaching Scheme (in Hours)			Total Credits L+T+ (PR/2)	Assessment Pattern and Marks				Total Marks
L	T	PR	C	Theory		Tutorial / Practical		
				ESE (E)	PA(M)	PA(I)	ESE (V)	
2	0	2	3	70	30	20	30	150



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Course Content:

Unit No.	Content	No. of Hours	% of Weightage
1.	Demonstrate Number systems and binary codes :Introduction of Digital Systems, Number Systems (Binary, Octal, Decimal, Hexadecimal) Binary Operations: Addition, Subtraction using 1's and 2's complement. Convert Number Systems and its Complements: Base Conversion Binary, Decimal, Octal, Hexadecimal,	06	20
2.	Binary Logic: Binary logic, Concept of Negative and Positive Logic Logic Gates: Logic Gates AND, OR, NOT, EX-OR, NOR, NAND, EX-NOR Interpret Boolean postulates, laws and theorems and Simplify Boolean Functions: Postulates , Laws, Boolean algebra, De-Morgan's Theorems, Boolean functions	07	23
3.	Boolean Function simplification using Karnaugh map: Need for Simplification, Simplification by Karnaugh map(K-map) method,2-Variable K-Map, 3-Variable K-Map, 4-Variable K-Map, K-Map using Don't care condition, Implementation of Boolean Function using Basic logic gates (AND, OR, NOT)	07	23
4.	Basic Combinational Circuits (Arithmetic and Logical): Introduction to combinational circuits. Basics of Arithmetic and logical combinational circuits and design with its Block Diagram, logic Diagram and Truth Table (Half Adder, Full Adder, Half Subtractor, Full Subtractor) Data Transmission Combinational Circuits: Basic Function and Block diagram of Encoder (4-2 Encoder). Basic Function and block diagram of Decoder (2-4 decoder). Introduction of Multiplexer (4-1 multiplexer), Block Diagram, logic Diagram and Truth Table. Introduction of Demultiplexer (1-4 Demultiplexer),Block Diagram, Logic Diagram and Truth Table	07	23



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5.	Basic Sequential Circuits: Introduction to Sequential circuits, Difference between Combinational circuit and Sequential circuit. Flip Flops: Introduction to Flip Flops and its types(SR Flip flop, JK Flip Flop, D Flip Flop, T Flip Flop:- Truth Table, Diagram)	03	11
Total		30	100

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks (in %)					
R Level	U Level	A Level	N Level	E Level	C Level
30	40	30	0	0	0

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)

References/Suggested Learning Resources:

(a) Books:

1. Kumar A. Anand, "Fundamentals of Digital Circuits", PHI.
2. M.Morris Mano, "Digital Logic and Computer Design", Pearson Education, Latest Edition
3. Jain R P, "Modern Digital Electronics", McGraw-Hill, Latest Edition.

(b) Open source software and website:

1. www.nptel.iitm.ac.in
2. www.vlab.co.in

Suggested Course Practical List:

1. Convert Number system to another (Binary, Decimal, Octal, Hexadecimal)
2. Perform Binary Addition and Subtraction and Calculate 1's and 2's Complements
3. Implement the basic logic gates.
4. Simplify and design Boolean expression using basic logic gates
5. Simplify Boolean expression using K-Map.
6. Design and implement Half Adder and full adder circuit.
7. Design and implement Half Subtractor and full Subtractor circuit.
8. Implement Multiplexer and Demultiplexer circuit
9. Implement Decoder and Encoder circuit
10. Study SR,JK,D and T flip-flops



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List of Laboratory/Learning Resources Required:

1. Logic Gates Digital Electronics Trainer kit
2. Digital Multimeter
3. Logic Probes/Analyzers
4. Breadboard, Connecting wires, Power supply

Suggested Activities for Students:

1. Design Boolean expression using basic logic gates and construct a flowchart
2. Undertake micro-projects in teams.
3. Prepare charts to explain types of flip flops.
4. Students are encouraged to register themselves in various MOOCs such as: Swayam to further enhance their learning.
